

299-E17-03 (A5880) Log Data Report

Borehole Information:

| | | | | | |
|-------------------------------------|--------------|----------------------------------|----------------------------------|-----------------------------|-------------|
| Borehole: 299-E17-03 (A5880) | | Site: 216-A-27 Crib | | | |
| Coordinates (WA State Plane) | | GWL (ft)¹: Dry | | GWL Date: 10/13/2003 | |
| North | East | Drill Date | TOC² Elevation | Total Depth (ft) | Type |
| 135,390.5 m | 575,160.63 m | March 1960 | 219.192 m | 400 | Cable Tool |

Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|---|---------------------|-----------------------------|------------------------------|------------------------|-----------------|--------------------|
| Welded steel | 0.75 | 8 5/8 | 8 | 5/16 | +0.75 | 398 |
| The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameters. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thicknesses were calculated. | | | | | | |

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS³, and Ledgerwood (1993). Zero reference is the top of the 8-in. casing.

Logging Equipment Information:

| | | | |
|--------------------------|----------|-------------------------------|------------------------|
| Logging System: | Gamma 1E | Type: | 70% HPGe (34TP40587A) |
| Calibration Date: | 07/2003 | Calibration Reference: | GJO-2003-468-TAR |
| | | Logging Procedure: | MAC-HGLP 1.6.5, Rev. 0 |

Spectral Gamma Logging System (SGLS) Log Run Information:

| Log Run | 1 | 2 | 3 | 4/Repeat | |
|-------------------|------------------|----------|----------|-----------------|--|
| Date | 10/14/03 | 10/15/03 | 10/16/03 | 10/16/03 | |
| Logging Engineer | Spatz | Spatz | Spatz | Spatz | |
| Start Depth (ft) | 115.0 | 304.0 | 130.0 | 113.0 | |
| Finish Depth (ft) | 1.0 | 129.0 | 114.0 | 83.0 | |
| Count Time (sec) | 100 | 100 | 100 | 100 | |
| Live/Real | R | R | R | R | |
| Shield (Y/N) | N | N | N | N | |
| MSA Interval (ft) | 1.0 | 1.0 | 1.0 | 1.0 | |
| ft/min | N/A ⁴ | N/A | N/A | N/A | |
| Pre-Verification | AE049CAB | AE050CAB | AE051CAB | AE051CAB | |
| Start File | AE049000 | AE050000 | AE051000 | AE051017 | |
| Finish File | AE049114 | AE050175 | AE051016 | AE051047 | |

| Log Run | 1 | 2 | 3 | 4/Repeat | |
|--------------------------|--------------------------|--------------------------|--------------------------|-----------------|--|
| Post-Verification | AE049CAA | AE050CAA | AE051CAA | AE051CAA | |
| Depth Return Error (in.) | -1 | 0 | N/A | -0.5 | |
| Comments | No fine-gain adjustment. | No fine-gain adjustment. | No fine-gain adjustment. | Repeat section. | |

Logging Operation Notes:

Zero reference was top of the 8-in. casing. Logging was performed with the centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K , ^{238}U , and ^{232}Th) verifier with serial number 118. Maximum logging depth achieved was 304 ft, approximately 1 ft above the telescoping screen.

Analysis Notes:

| | | | | | |
|-----------------|---------|--------------|----------|-------------------|------------------------|
| Analyst: | Sobczyk | Date: | 11/03/03 | Reference: | GJO-HGLP 1.6.3, Rev. 0 |
|-----------------|---------|--------------|----------|-------------------|------------------------|

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 5.9 percent higher and 2.3 percent lower at the end of the day.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Pre-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJul03.xls). Zero reference was the top of the 8-in. casing. On the basis of Ledgerwood (1993), the casing configuration was assumed to be one string of 8-in. casing to total log depth (304 ft). The casing correction factor was calculated assuming an 8-in. casing thickness of 5/16 in. This casing thickness is based upon the field measurement. Water and dead time corrections were not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, comparison log plots of man-made radionuclides are provided to compare the data collected in 1992 and 1995 by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in the intervals from 13 to 14 ft and 111 to 113 ft. The range of concentrations was from 0.2 pCi/g to 0.8 pCi/g. The maximum concentration was measured at 111 ft. ^{137}Cs was also detected at log depths of 1, 9, 40, 167, and 208 ft at concentrations near the MDL (0.2 pCi/g). ^{60}Co was detected in the intervals between 111 to

112 ft and 284 to 304 ft. The range of concentrations was from 0.1 pCi/g to 4.9 pCi/g, which was measured at 291 ft. ⁶⁰Co was also detected at log depths of 87, 204, 258, and 269 ft at concentrations ranging from the MDL (0.1 pCi/g) to 0.2 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. Changes of about 4 pCi/g in apparent ⁴⁰K concentrations occur at 18, 83, 90, 255, and 272 ft. Both ²³⁸U and ²³²Th concentrations are elevated by approximately 0.5 pCi/g in the interval between 285 and 292 ft relative to the surrounding sediments. This interval corresponds with a sand and clay interval on the driller's log (Ledgerwood 1993).

Between 260 and 129 ft (during log run 2), ²³⁸U (609 keV) concentrations were about 0.3 pCi/g higher than those based on the 1764-keV photopeak. This behavior suggests that radon may be present inside the borehole casing. The *Hanford Geophysical Logging Project, Data Analysis Manual* (GJO-HGLP 1.6.3, 2003) describes the effects of radon on borehole logging.

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the man-made radionuclides (661, 1173, and 1333 keV) and natural radionuclides (609, 1461, 1764, and 2614 keV).

Gross gamma logs from Additon et al. (1978) (attached) indicate that the sediments surrounding this borehole contained significant amounts of man-made gamma radiation from 1963 through 1976. The log from 5/21/63 appears to detect relatively high gamma activity in the intervals from 75 ft (23 m) to 138 ft (42 m) and 279 ft (85 m) to total depth (123 m). The log from 4/28/76 appears to detect relatively high gamma activity in the intervals from 79 ft (24 m) to 131 ft (40 m) and from 279 ft (85 m) to 318 ft (97 m). The SGLS detected low levels of ¹³⁷Cs and ⁶⁰Co in the intervals from 87 to 113 ft and 284 ft to total log depth (304 ft).

Comparison log plots of data collected in 1992 and 1995 by Westinghouse Hanford Company (WHC) and in 2003 by Stoller are included. The WHC concentration data for ¹³⁷Cs and ⁶⁰Co are decayed to the date of the SGLS logging event in October 2003. The SGLS and RLS logs appear to use a slightly different depth reference. ¹²⁵Sb was detected on the RLS logs in the interval between 84 and 125 ft with a maximum concentration of 6 pCi/g in 1992. Due to its short half-life, ¹²⁵Sb was not detected by the SGLS because the concentrations had decayed below the SGLS's MDL. Since 1992, ¹³⁷Cs and ⁶⁰Co activities have decreased as predicted by radioactive decay.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

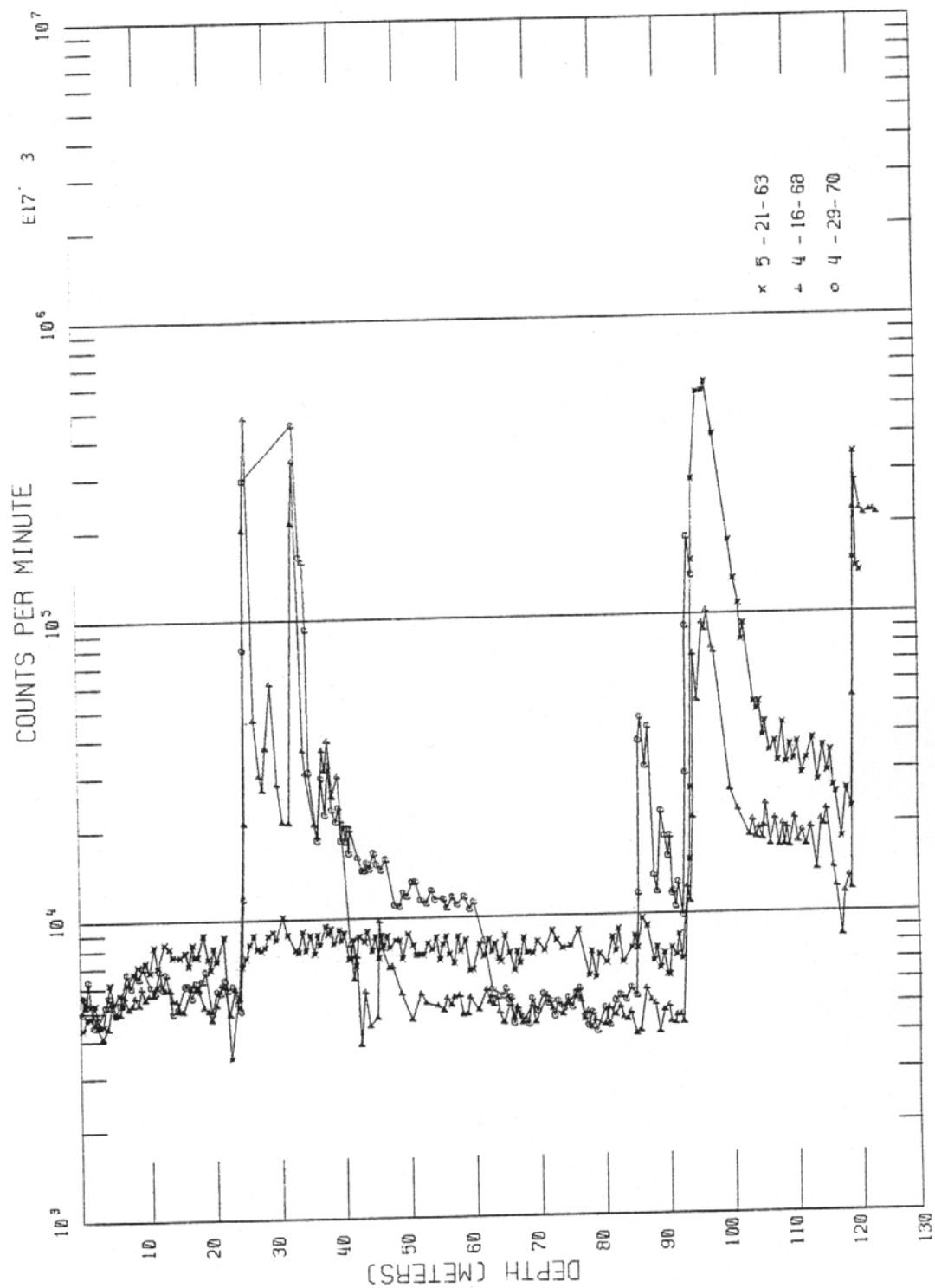
Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

¹ GWL – groundwater level

² TOC – top of casing

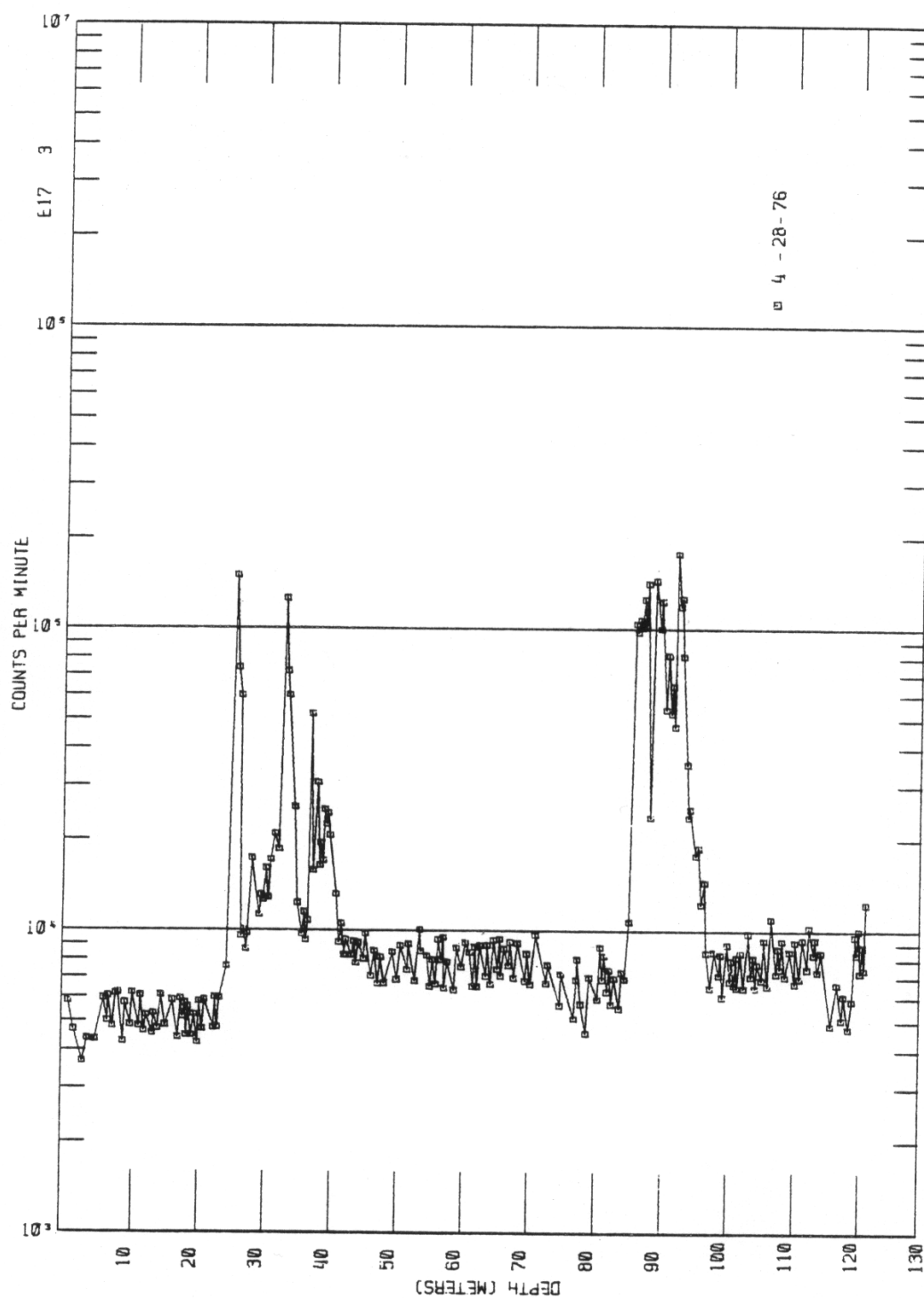
³ HWIS – Hanford Well Information System

⁴ N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E17-3, Logged on 5/21/63, 4/16/68, and 4/29/70



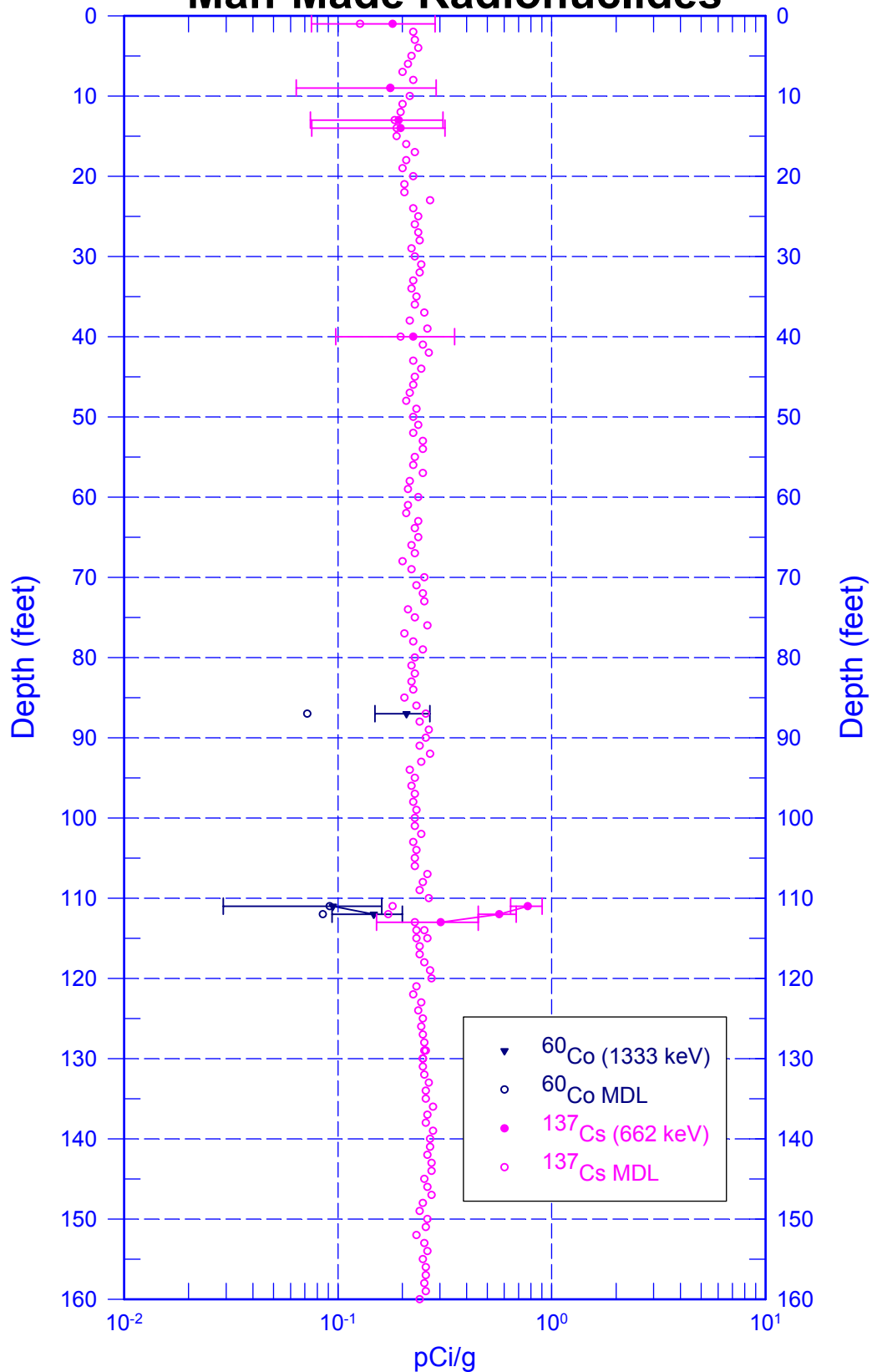
WELL E17-3 SCINTILLATION PROBE PROFILE

from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E17-3, Logged on 4/28/76

299-E17-03 (A5880)

Man-Made Radionuclides

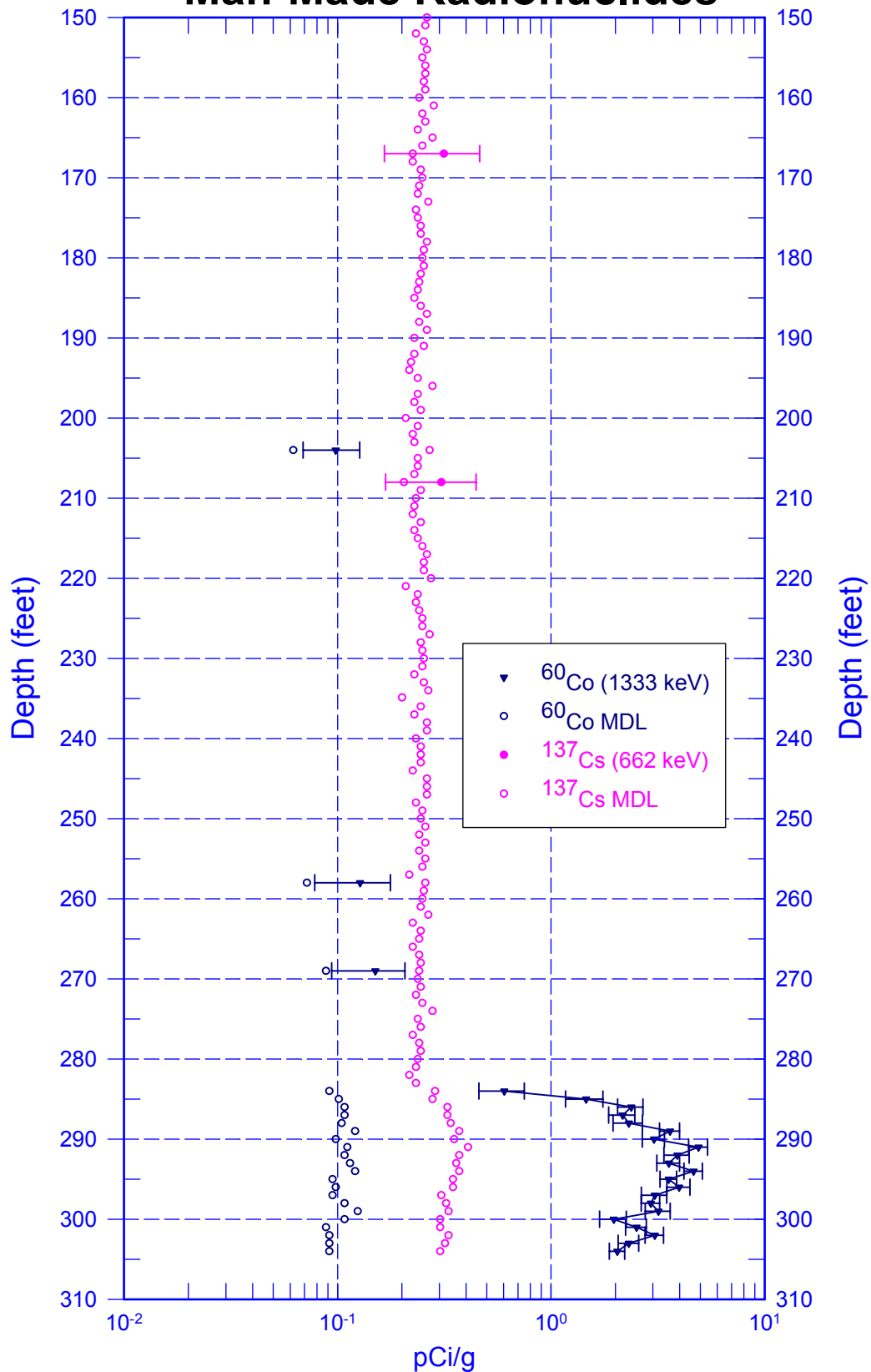


Zero Reference = Top of Casing

Date of Last Logging Run
10/16/2003

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Man-Made Radionuclides

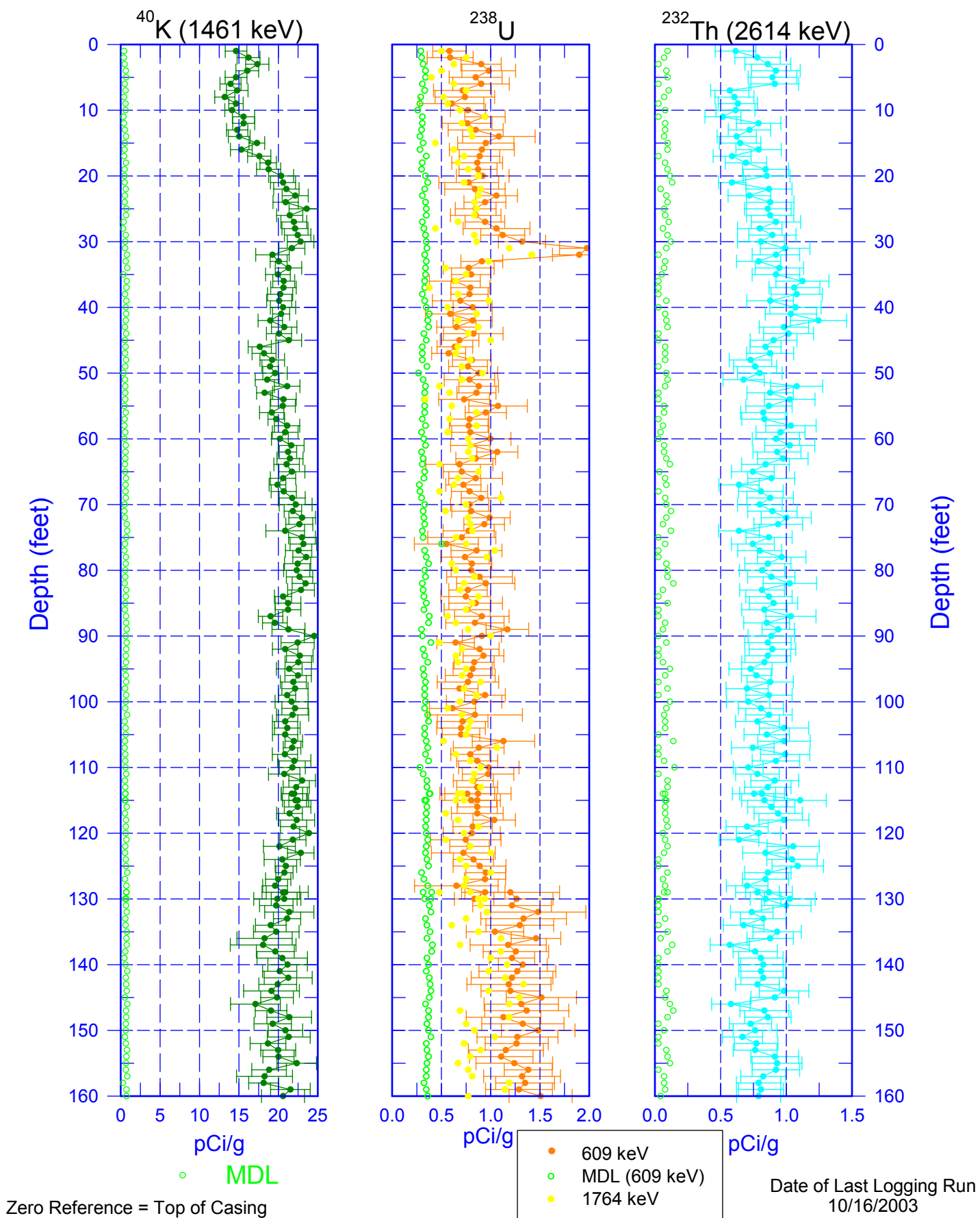


Zero Reference = Top of Casing

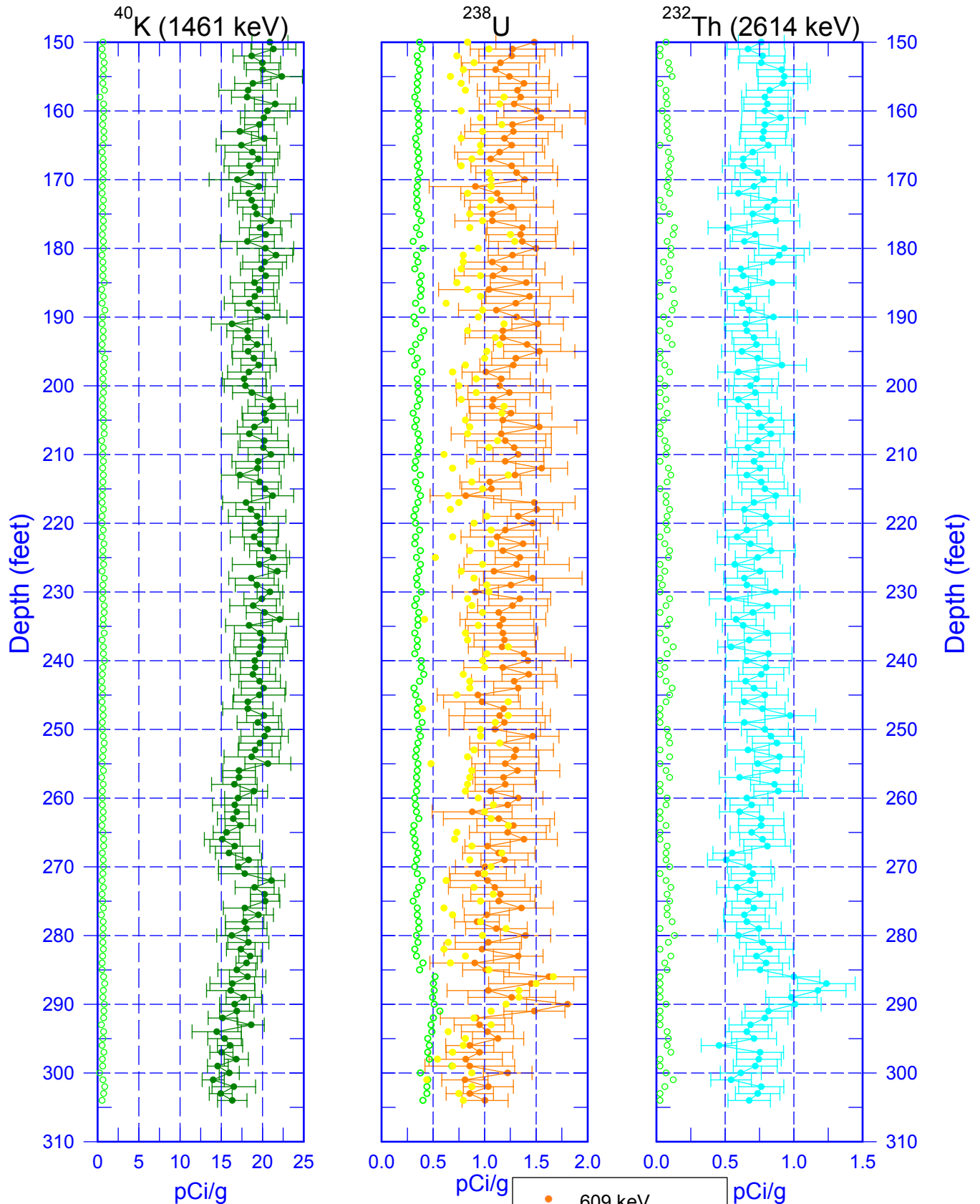
Date of Last Logging Run
10/16/2003

299-E17-03 (A5880)

Natural Gamma Logs



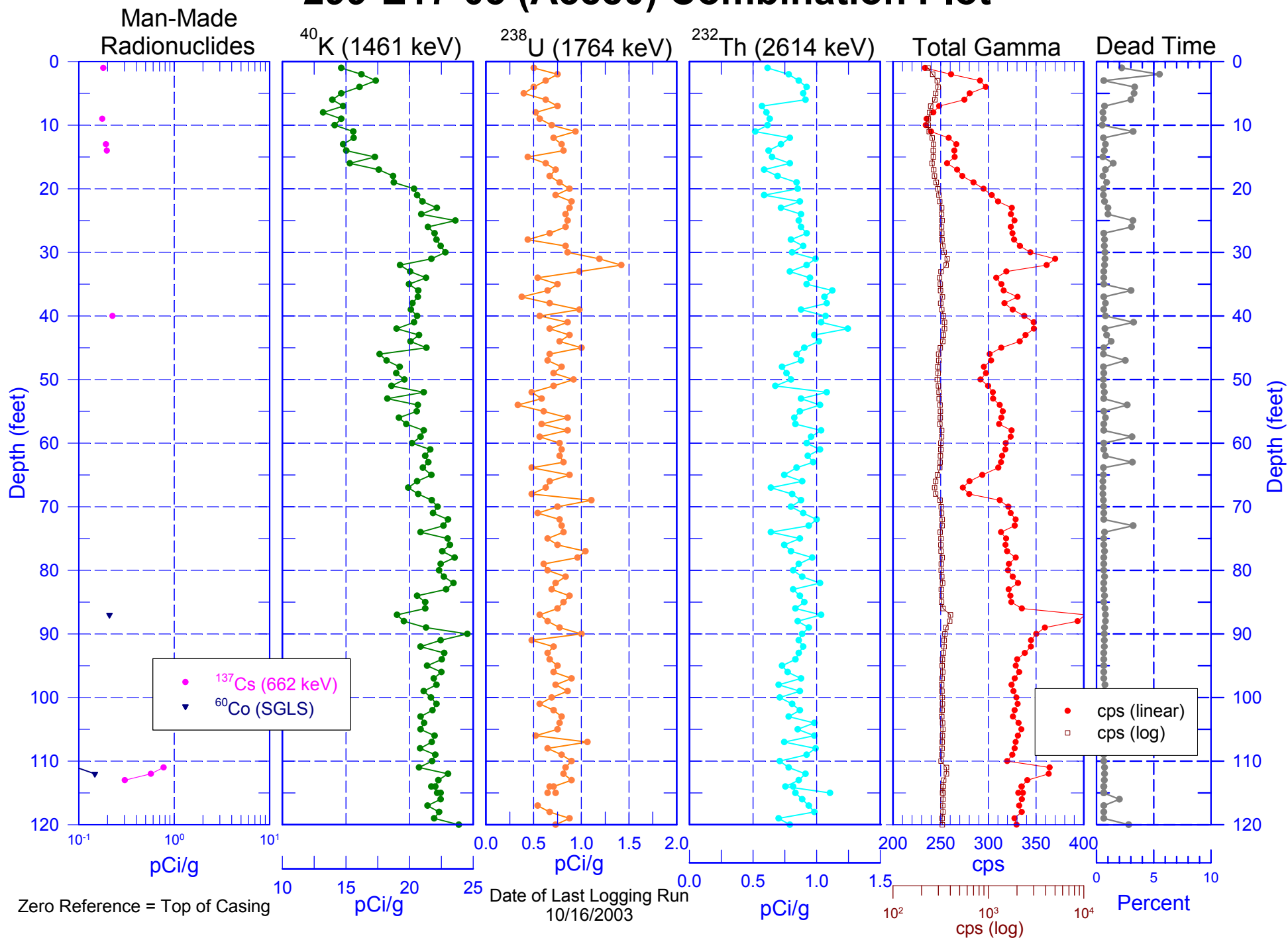
299-E17-03 (A5880) Natural Gamma Logs



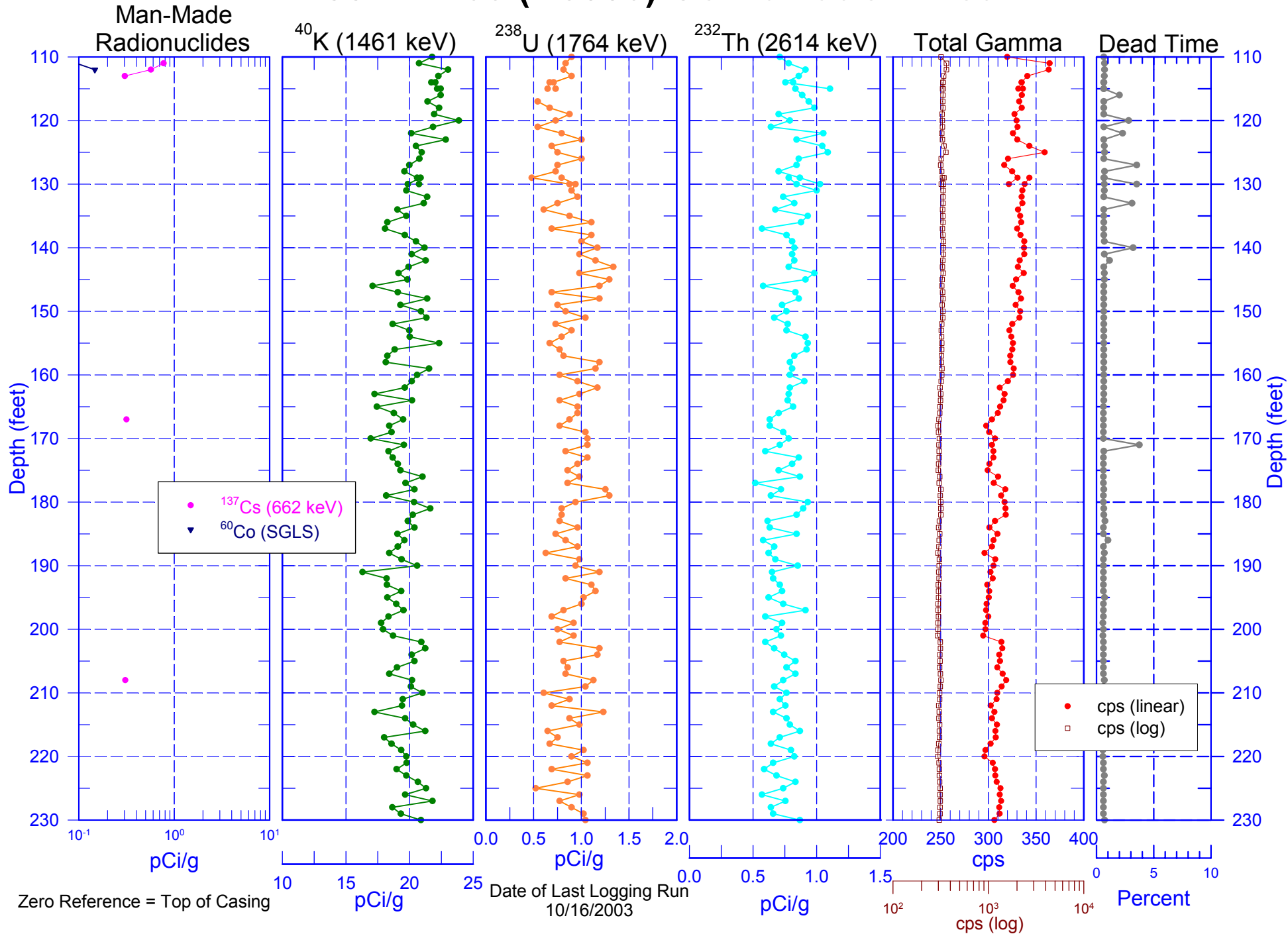
Zero Reference = Top of Casing

Date of Last Logging Run
10/16/2003

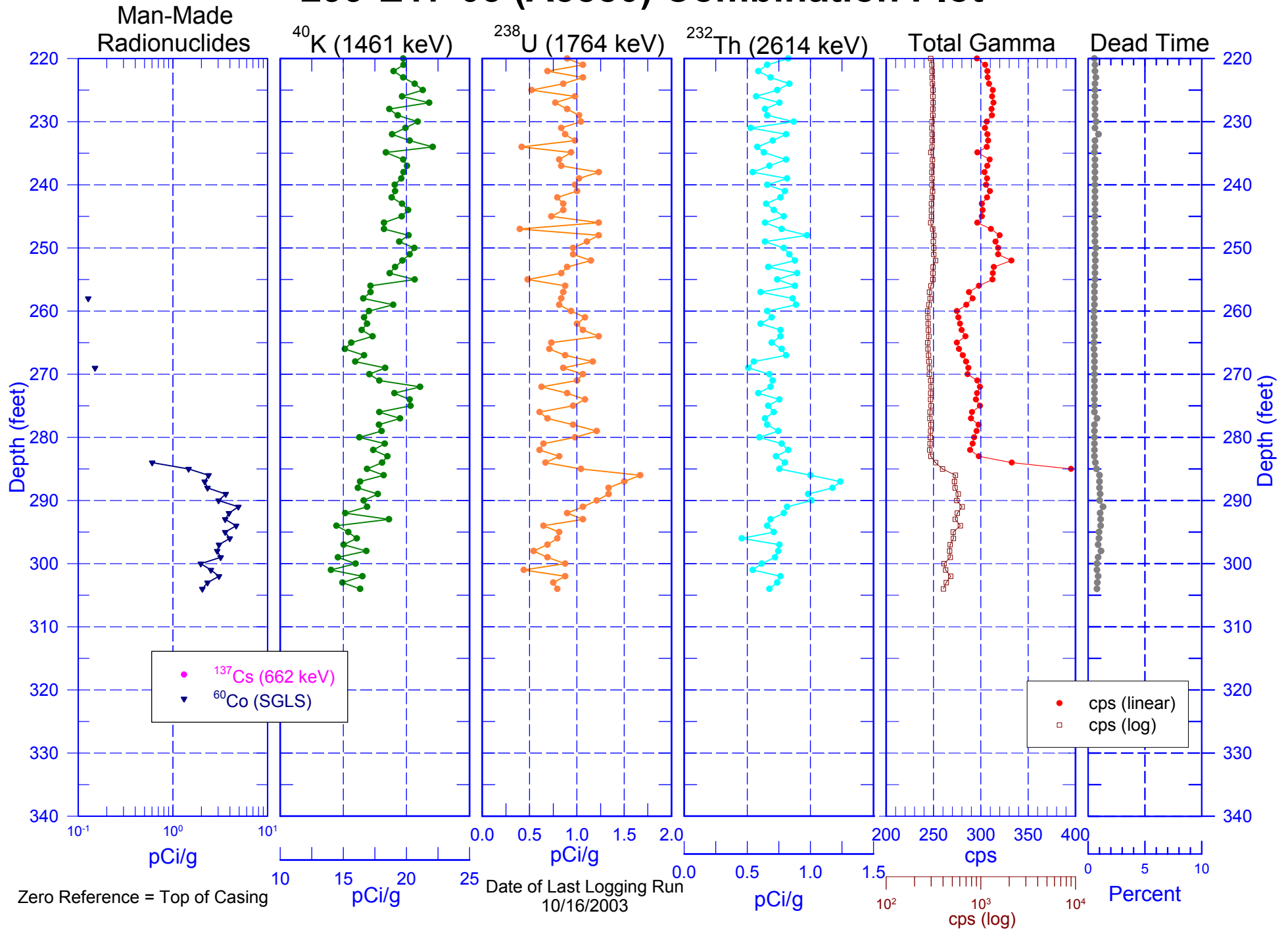
299-E17-03 (A5880) Combination Plot



299-E17-03 (A5880) Combination Plot

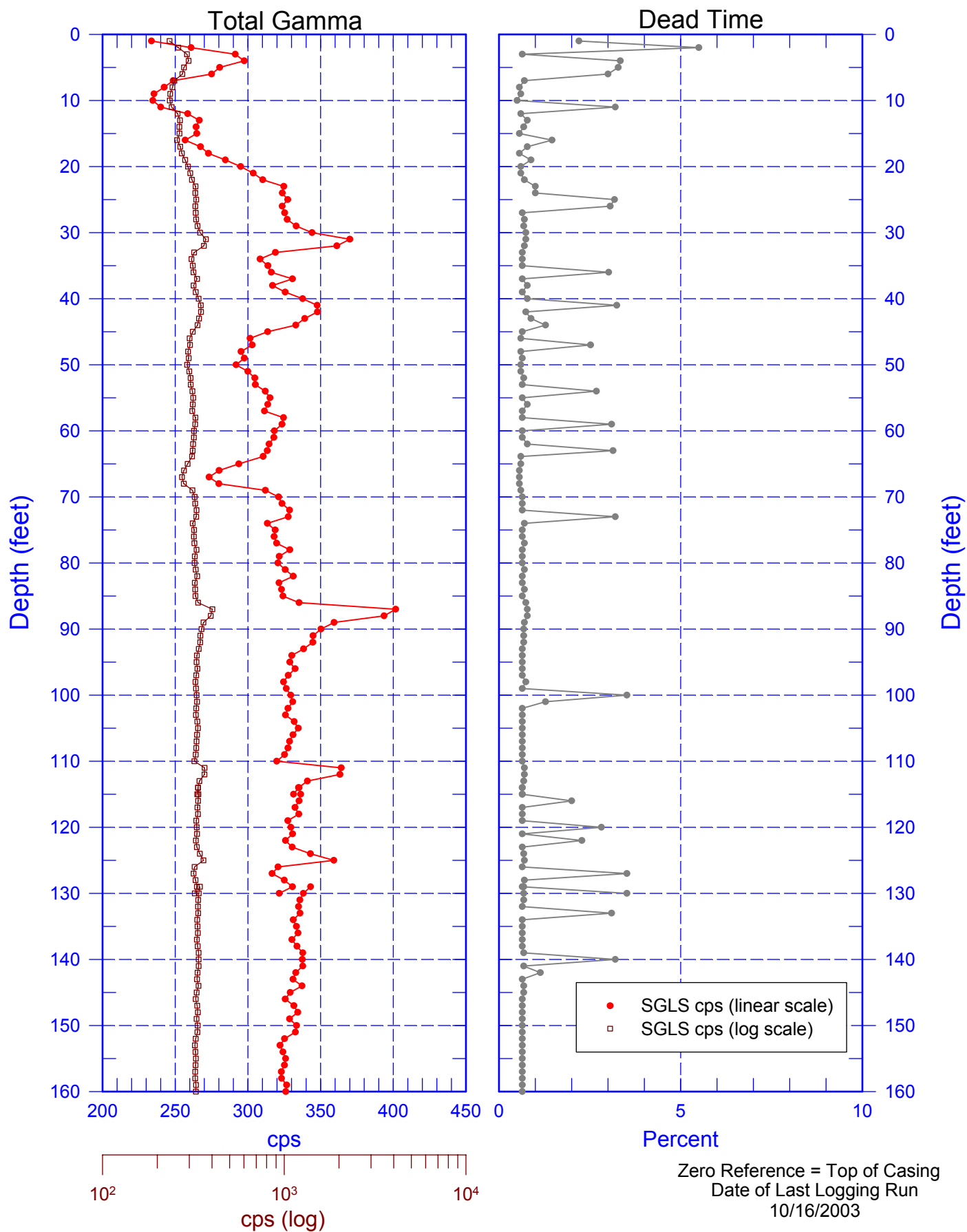


299-E17-03 (A5880) Combination Plot



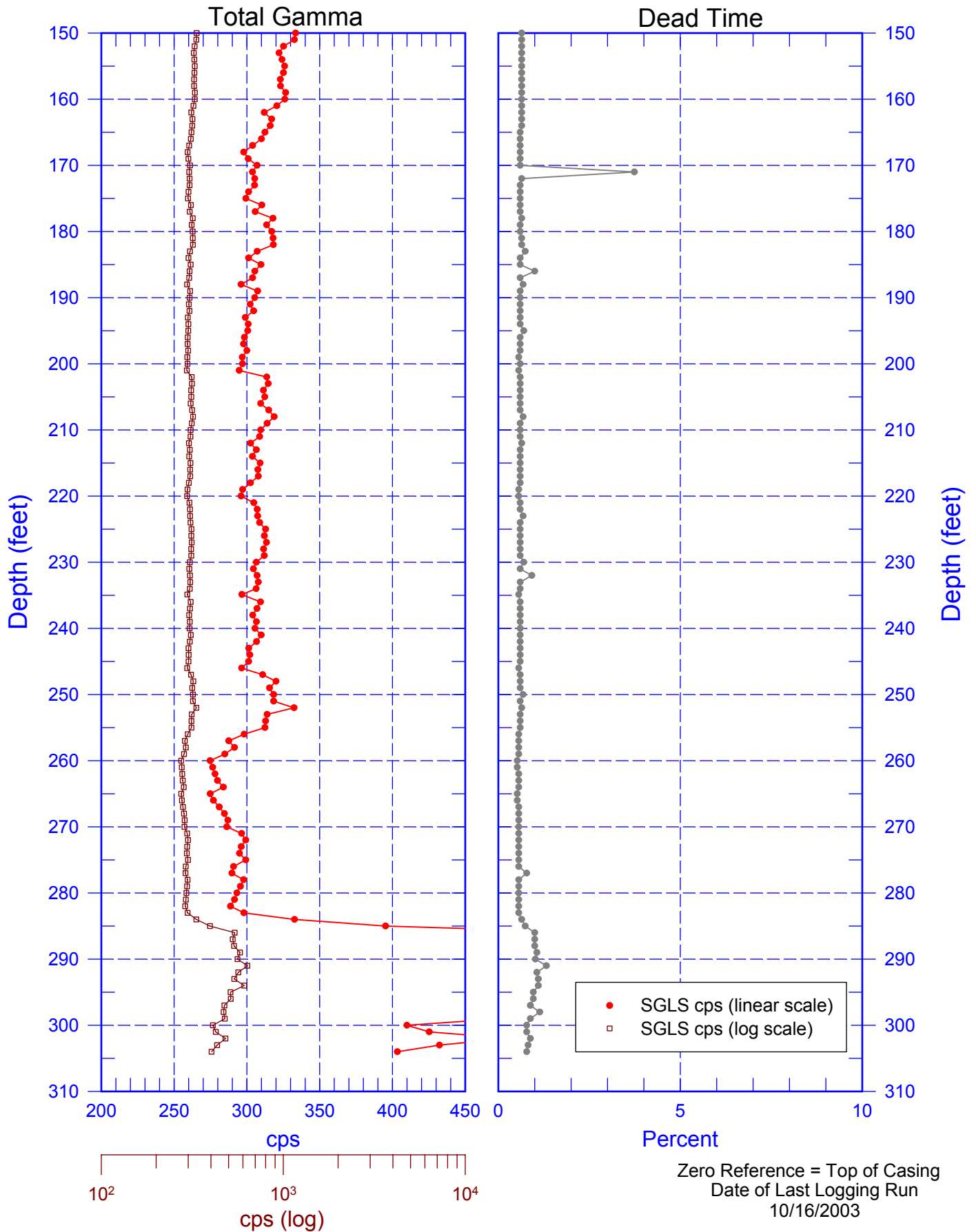
299-E17-03 (A5880)

Total Gamma & Dead Time



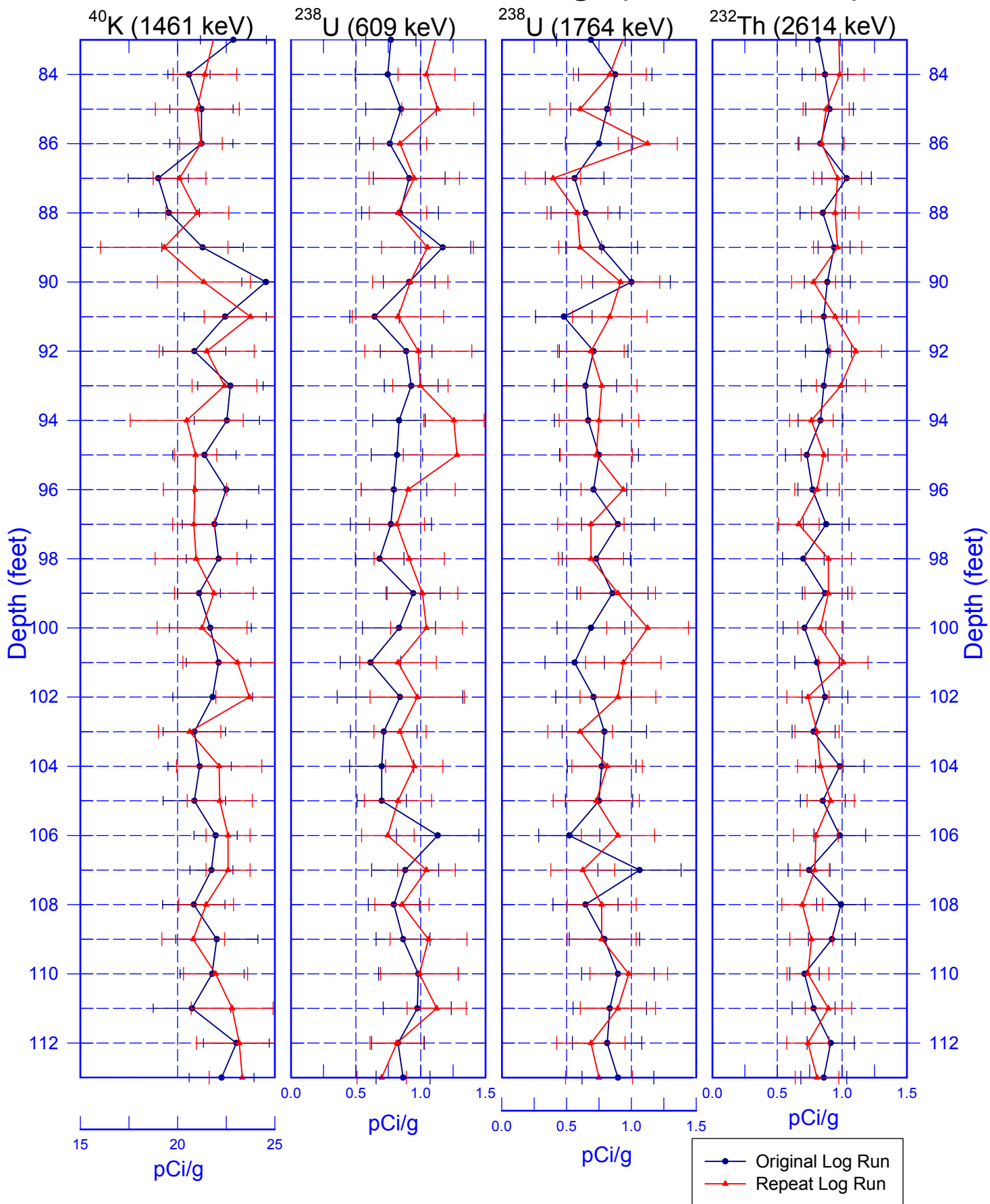
299-E17-03 (A5880)

Total Gamma & Dead Time



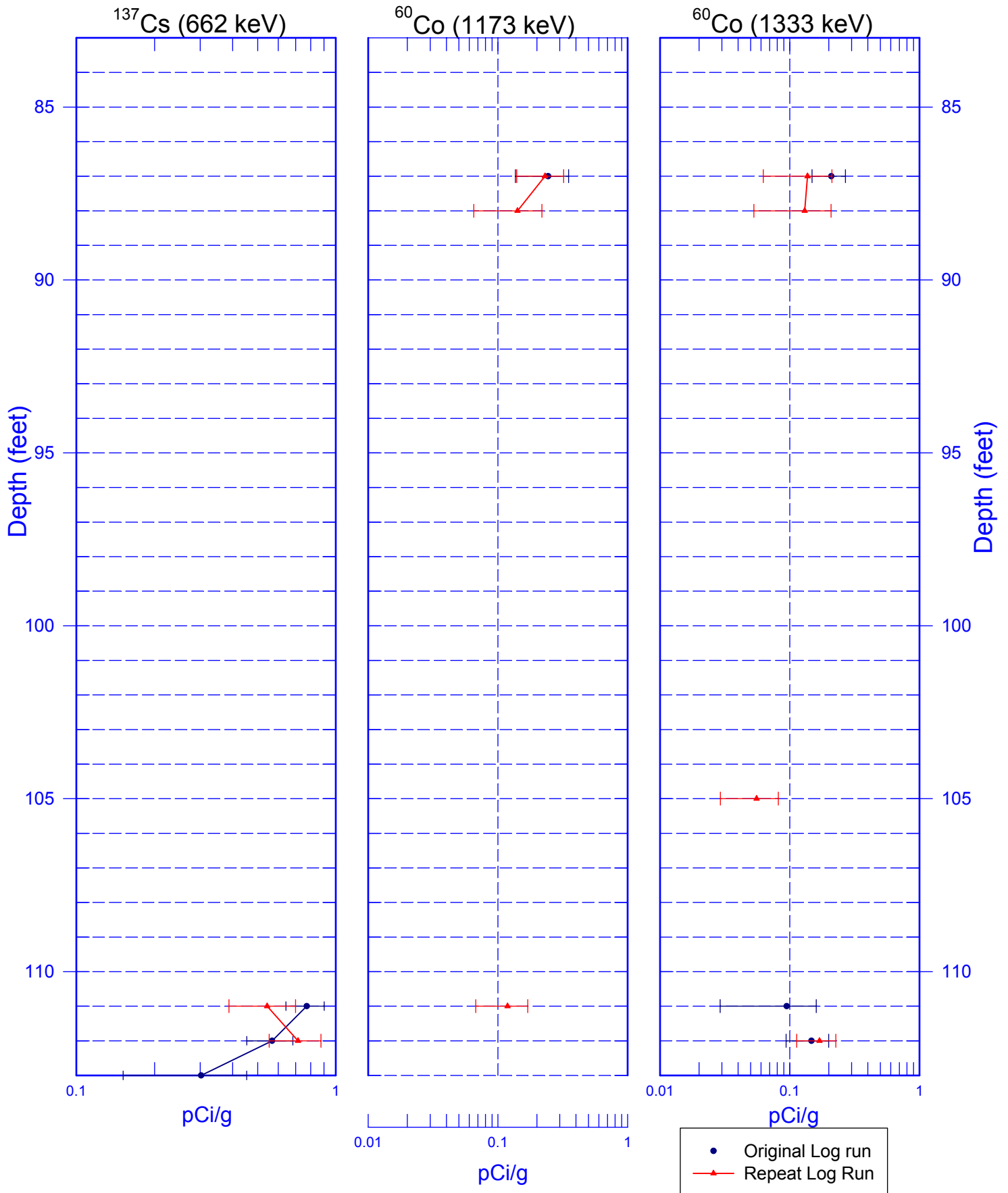
299-E17-03 (A5880)

Rerun of Natural Gamma Logs (113.0 to 83.0 ft)



299-E17-03 (A5880)

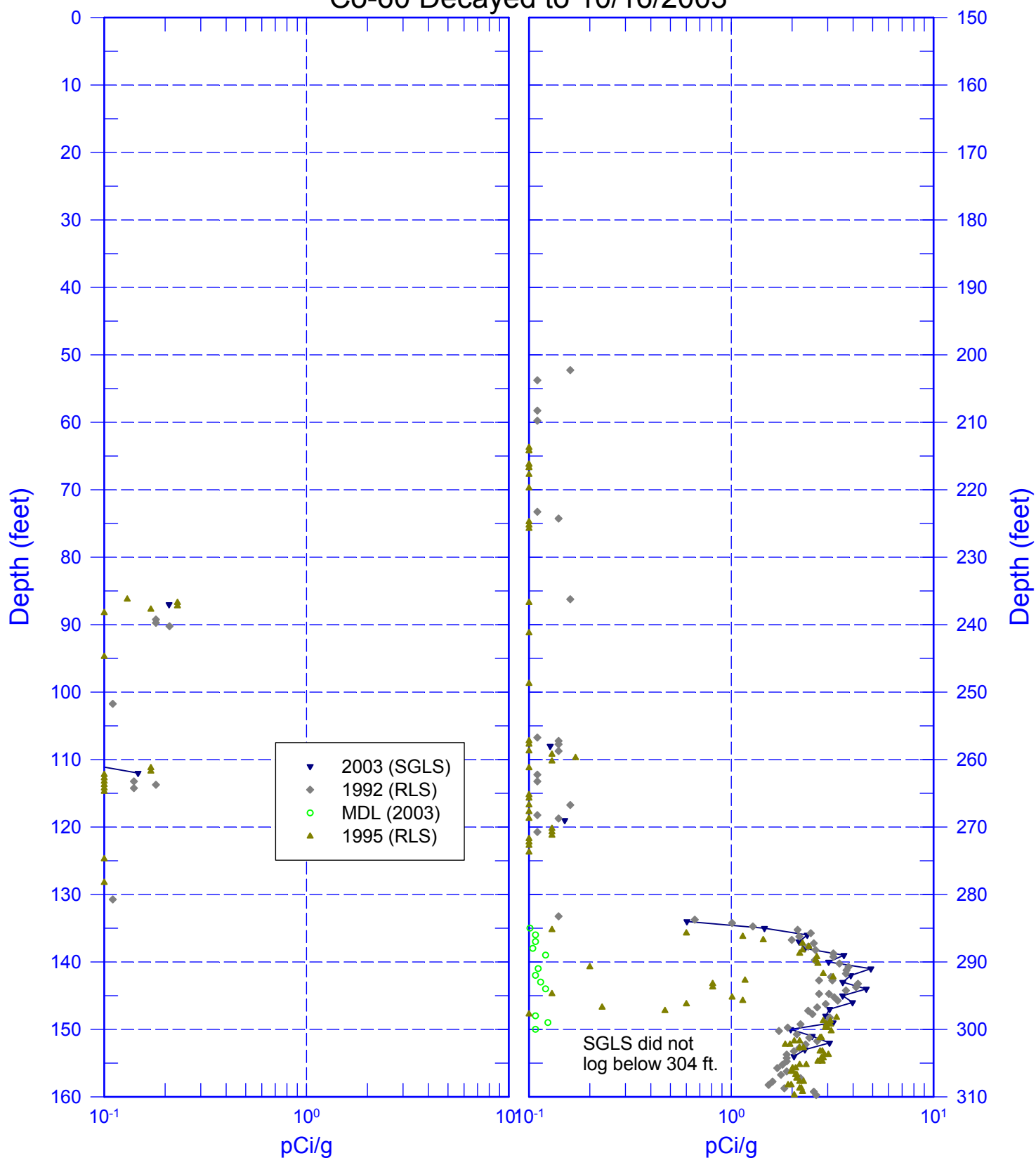
Rerun of Man-Made Radionuclides (113.0 to 83.0 ft)



299-E17-03 (A5880)

RLS Data Compared to SGLS Data

Co-60 Decayed to 10/16/2003

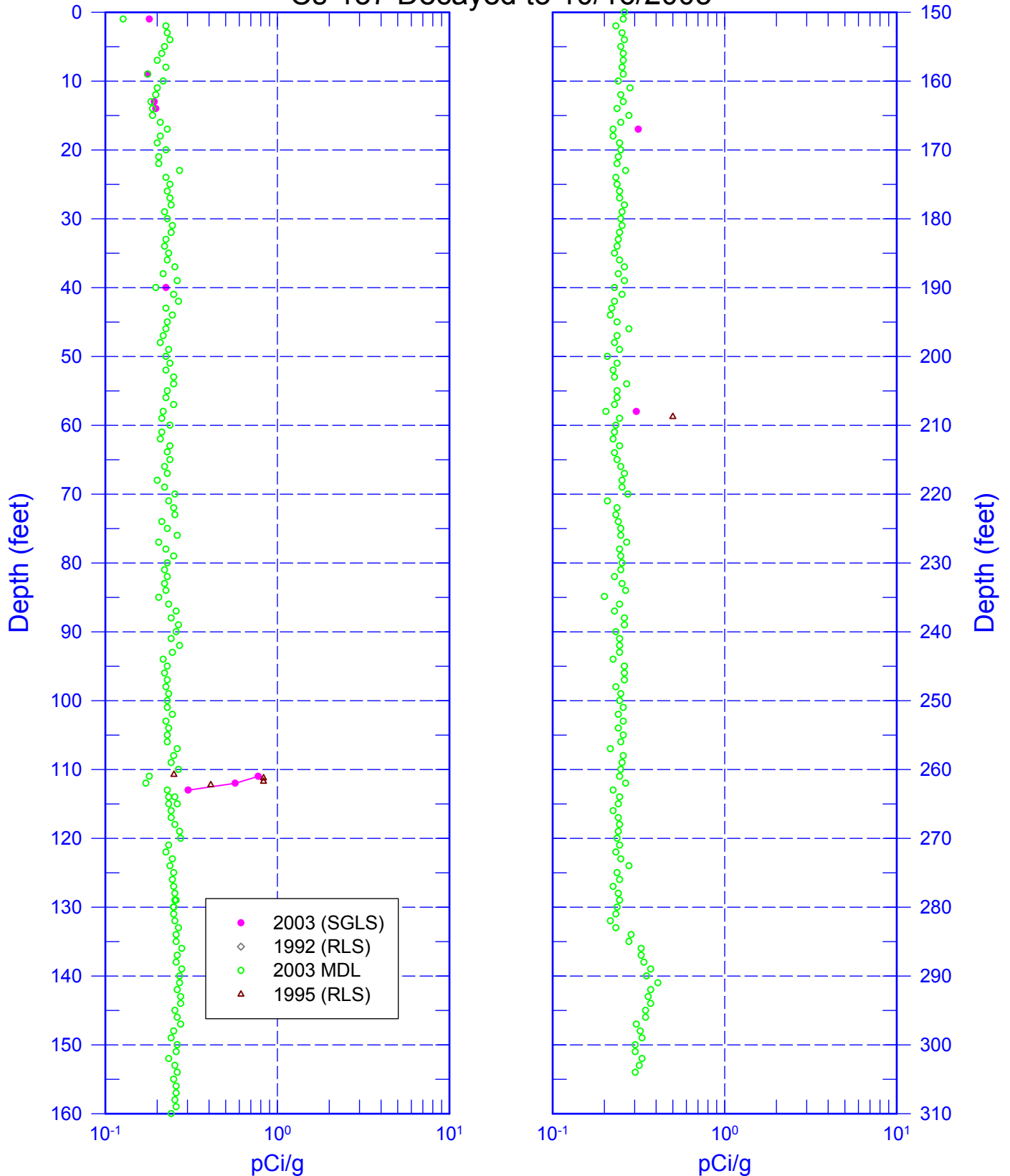


Zero Reference = Top of Casing (2003 SGLS)
 1992 RLS data shifted +3.75 to align with 2002 SGLS
 1995 RLS data shifted -1.25 to align with 2002 SGLS

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RLS Data Compared to SGLS Data

Cs-137 Decayed to 10/16/2003



Zero Reference = Top of Casing (2003 SGLS)
1995 RLS shifted -1.25 ft to align with the SGLS
1992 RLS shifted +3.75 ft to align with the SGLS